INTERIM
POLLUTION REDUCTION STRATEGY
FOR
ONTARIO KRAFT MILLS

APRIL 1989

Environment Ontario

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Minister

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EXECUTIVE SUMMARY

This position paper describes the Ministry of the Environment's program for reducing kraft mill water pollution. The Ministry's strategy is to protect Ontario's waterways by systematically reducing toxic discharges until the goal of virtual elimination of persistent toxics is achieved. At the same time, discharges of conventional pollutants will also be greatly reduced, and mill effluent will be rendered non-lethal to fish.

An abatement regulation under the MISA (Municipal-Industrial Strategy for Abatement) program will be promulgated in 1991 specifying effluent limits on conventional and toxic pollutants. The regulation will be based on the best available technology economically achievable (BATEA). Companies must comply with these limits by 1993. The abatement regulation and the definition of BATEA limits will be developed in consultation with industry and the public, as specified in the MISA White Paper of 1986.

Periodic review of BATEA limits will be conducted to determine when technological advancements allow a further tightening of discharge limits. When they do, the Ministry will impose more stringent limits, until virtual elimination of persistent toxics is achieved.

For the interim period, before the MISA abatement regulation is promulgated, the Ministry will be issuing Control Orders requiring immediate abatement action by Ontario's bleached kraft mills. The action called for under Control Orders will result in significant reductions of both conventional and toxic pollutants and

will serve as a first step to achieving the more stringent levels imposed under the abatement regulation. Again, the development of the Control Orders will be carried out with input from industry and the public.

The Ministry's control strategy has been developed after careful consideration of the recommendations recently given by an independent body of experts. The Kraft Mill Effluents in Ontario report, which is described in this document, identifies limits for toxic and conventional pollutants and recommends proven and practical technologies for achieving these limits.

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INTRODUCTION

The Environmental Challenge

Pulping and paper-making processes use vast amounts of water. The resultant effluent contains substantial amounts of conventional and toxic pollutants.

In the past decade, the industry has taken steps to control some of the pollutants in its effluents. Of the 27 pulp and paper mills discharging directly to Ontario's waterways, all have primary treatment and six have some form of secondary treatment. As a result, loadings of conventional and toxic pollutants have been reduced. In fact, since the early 1980's though total production has increased by about 20 percent, the industry has reduced the biochemical oxygen demand (BOD) and suspended solids loadings in its effluents by approximately one-third.

However, recent studies and a greater understanding of the threat posed by persistent toxics, show that these measures do not provide an acceptable level of pollution abatement. Concern has focussed particularly on the discharges from the nine mills producing bleached kraft pulp. These mills, the largest in the sector, discharge in total nearly a million cubic metres of effluent each day -- a volume equal to the sewage produced by a population of two million people. The final effluent from many of these mills is as potent as raw municipal sewage in terms of biochemical oxygen demand. Resin and fatty acids and sulphur compounds from the pulping process are discharged, and these are acutely toxic. A recent Ministry study, covering the past few years, indicated that effluent from eight of the nine kraft mills is acutely toxic to fish.

In addition to size, these mills are distinct from others in the pulp and paper sector, by their use of chlorine to bleach the pulp. Chlorine bleaching dissolves lignins from the wood and this results in waste streams containing significant loadings of chlorinated organic compounds and other persistent toxic substances.

The greatest concern arises from the presence of this broad range of chlorinated organic compounds. There are thousands of these compounds, including the family of chemicals called dioxins and furans, and all are formed when organic molecules bond with chlorine atoms. Although scientists are in the early stages of studying these compounds, they do know that many chlorinated organic compounds are persistent and toxic, and some bioaccumulate and bioconcentrate in the environment and the food chain. Recent studies have shown that five of seven mills surveyed had the most toxic form of dioxins (2,3,7,8-TCDD) at low concentrations in their effluent, and six of the seven had furans. Also, research in Sweden has linked chlorinated organics from kraft mill effluent with genetic defects in fish.

Estimates of chlorinated organic compounds discharged by Ontario's kraft mills range from 150 to over 200 tonnes each day. These loadings must be reduced and eventually eliminated to protect the aquatic environment, the food chain and the people of Ontario.

Previously, chlorine bleaching was regarded as essential to provide the quality consumers demanded in white paper products. The large amounts of chlorine used in bleaching, combined with the organic compounds present in wood, naturally resulted in large loadings of chlorinated organics.

Recently, however, some mills in Ontario and a number of others around the world have greatly reduced their use of chlorine in the bleaching process by applying alternative process technologies. These technologies, used in conjunction with traditional pollution controls, make it possible to considerably reduce the discharge of both conventional pollutants and toxic substances including chlorinated organic compounds.

The Economic Challenge

Economic factors cannot be excluded from the development of a pollution control strategy for this industry. The Ministry has carefully considered the impact of the requirements it will be imposing and has determined that Ontario's kraft mills can achieve the limits called for, in most cases, without threat to their economic viability.

Included in the Ministry's consideration was the important economic contribution made by the pulp and paper industry. The latest figures (1984) show that this industry as a whole provides 2.5 percent of Ontario's total manufacturing employment and 3 percent of the manufacturing wages. The nine bleached kraft mills contribute a significant portion of these totals. In addition, a number of the mills are located in smaller towns, mainly in the northern parts of the province where the town's livelihood depends upon the existence of the mill.

Looking beyond Ontario's borders, kraft mills export the vast majority of the pulp sold to an increasingly competitive world market. In addition to the traditional competitors such as the United States and Scandinavia, Ontario mills face the challenge posed by emerging South American nations and other Third World countries.

Finally, pulp producers around the world traditionally operate in a cyclical economic climate. The cyclical nature of kraft mill economies suggests that costs of pollution control are best absorbed in a period of prosperity. The market for kraft mill products is currently buoyant and this is a good time to make financial commitments to pollution control.

"KRAFT MILL EFFLUENTS IN ONTARIO" REPORT

In 1986, the Ministry issued a Control Order requiring the effluent from Kimberly-Clark's kraft mill at Terrace Bay to pass a fish test for acute toxicity. Kimberly-Clark contested the Control Order: it felt that the measure was unnecessary and prohibitively expensive. Subsequent discussion indicated the need for further study of toxicity testing methods and the economic impact of treatment technology.

The Ministry therefore commissioned an independent body of experts to review these issues. Later, as the MISA regulatory program commenced for the pulp and paper sector, the committee's mandate was expanded to cover all nine kraft mills and the terms of reference were broadened.

Specifically, the committee was asked to: identify the most economic and effective ways to reduce the discharge of both acute and persistent toxic substances; review toxicity testing and recommend possible improvements; identify the pollutants that cause toxicity and their sources in the production process; review the economic implications of installing and operating toxicity reduction measures.

To fulfill this mandate, the committee conducted an extensive review of the literature and visited each of the kraft mills. Members of the committee also consulted with industry, government and academia in Canada, the United States and Scandinavia. A final report of their findings was submitted in March of 1988. This report has since been published by the Ministry and reviewed by the public and by Ministry staff.

Kraft Mill Operations and Effluent

Pollution reduction techniques are inextricably intertwined with production processes. The following overview of mill operations briefly describes the chief causes and sources of polluting substances.

The process begins in the yard where dirt and debris attached to logs are removed. Some mills use large circulating water flows for this cleaning. Resin acids and other materials acutely toxic to fish can pass into the wash water.

Once in the mill, the logs are debarked and chopped into wood chips. To remove the bark, the logs rotate in drums and are washed with large volumes of water. This process produces an effluent stream that is acutely toxic to fish and contains significant loadings of resin and fatty acids, biochemical oxygen demand (BOD) and suspended solids. Some mills have reduced this problem by employing a dry debarking system, which results in little or no effluent being produced.

At the next stage the chips are "cooked" in alkaline solution or liquor, to remove lignin and produce pulp. The spent liquor is sent to a recovery furnace where water is evaporated and organic materials are incinerated. Inorganic chemicals form a liquid smelt

from which the "cooking" liquor is recovered chemically and returned to the process. At this stage there are two factors, cited in the report, which affect the quality of effluent. First, liquor that is not removed from the wood pulp will be extracted later in the process, but at that point will be discharged and not sent through a recovery process. Second, lignin remaining in the pulp fibres will be bleached out in the next stage. A higher percentage of lignin will require more extensive bleaching, and this bleaching process is the source of chlorinated organic contaminants in the wastewater discharged to the environment.

Normally, pulp arriving at the bleach plant retains about seven per cent by weight lignin and other material. This remaining lignin produces a brown colour which is acceptable for kraft papers used for grocery shopping bags and towels, but not for finer printing papers. A bleaching process, using several chlorine, chlorine dioxide and hypochlorite stages, converts the lignin into compounds which can be separated from the fibre. The effluent streams from these stages contain half of the BOD and much of the acute toxicity in mill discharges. They also contain chlorinated organic compounds. According to the report, these compounds pose the greatest potential threat to the environment.

Chlorinated Organic Compounds

Chlorinated organic compounds are formed when chlorine, a highly reactive compound, bonds to organic molecules. The result is a vast array of compounds, some of which are very toxic and are known to persist in the environment. Chlorinated dioxins and chlorinated furans are among the more toxic compounds produced.

Although there is still much to learn about chlorinated organics, research to date clearly indicates a need for caution. A ten-year study conducted in Sweden on fish from waters contaminated by kraft mill effluents showed a number of developmental anomalies including enlarged livers, diminished white blood cell count, erosion of fins and delay of gonad development. The Swedes also reported that fish stocks are depleting in these waters.

In Ontario, chlorinated dioxins and chlorinated furans have been found in fish taken in the vicinity of kraft mills.

According to the Kraft Mill Effluents in Ontario report, scientists have identified more than 300 different chlorinated organic compounds in kraft mill effluent. These compounds, however, only account for about 10% (or 20 tonnes) of the over 200 tonnes chlorinated organics discharged each day by all the Ontario's kraft mills. The authors of the "Kraft Mill Effluents in Ontario" report point to the other 90% as the gravest cause for concern. They feel the hazard posed by the unidentified compounds which compose some 200 tonnes of chlorinated organics loading to the environment necessitates immediate action, even while ongoing assessments are made. This approach is further supported by the fact that pollution control measures will involve complex changes to mill operations and will require up to five years to implement.

Pollution Control Technology

The report describes four pollution control technologies which the authors consider to be proven, practical and economically achievable. Three of the technologies --

oxygen delignification, high chlorine dioxide substitution and extended delignification -- involve changes to internal processes. The fourth, biological treatment, normally requires an aerated lagoon at the end of the manufacturing process.

Oxygen delignification uses oxygen to remove more lignin from the pulp after the cooking process. Because this additional lignin has been removed, less chlorine is required in the bleaching process. Also, the spent oxygen filtrate can be sent to a recovery furnace where organic materials are incinerated and inorganics are recovered and recycled into the process. Using oxygen delignification and a recovery furnace, mills could reduce the amount of BOD, colour and chlorinated organics in their effluent by as much as fifty percent. It would also reduce mill operating costs as oxygen is less expensive than chlorine.

High chlorine dioxide substitution replaces a high percentage of the elemental chlorine used in bleaching with chlorine dioxide. This substitution offers a comparatively low cost method of reducing chlorinated organic compounds in the effluent although it has no effect on BOD and an unknown effect on acute toxicity.

The authors of the report describe the third process change, extended delignification, as feasible for new plants but not a practical technology for retrofit into existing operations. Extended delignification increases the time wood chips "cook" in the digestor during pulping. This would increase the amount of lignin removed, which would reduce the subsequent bleaching requirements. Organochlorines in effluent could be reduced by as much as 20 percent and a moderate reduction in BOD would be achieved.

The quality of effluent could also be improved with the application of end-of-the-pipe treatment. For example, an aerated lagoon retaining effluents before discharge to the environment would provide biological treatment. The treatment converts much of the organic material in these wastes into water, carbon dioxide or organic sediments. A key factor is the efficient operation of the treatment plant: well operated plants achieve BOD reductions of 70-90 percent and would reduce organochlorines up to 33 percent. In addition, the treatment would considerably reduce the acute toxicity of effluent.

Report Recommendations

The authors of the Kraft Mill Effluents in Ontario report conclude that kraft mills should act promptly to reduce the generation and discharge of persistent toxics, and should eventually eliminate them. Mills should also continue to control conventional pollutants at levels similar to those currently imposed, they said.

These conclusions reflect the environmental threat posed by organochlorines, particularly the vast amounts discharged by kraft mills. They also reflect findings that practical, proven technology exists which is capable of reducing toxic and conventional pollutants. Finally, an economic assessment carried out by the authors indicated that this technology is clearly affordable by most mills.

The report provides a control strategy based on four levels of environmental protection (Table 1).

TABLE 1

LEVELS OF ACHIEVEMENT FOR KRAFT COMPONENT OF PULP AND PAPER MILL EFFLUENTS

Level	BOD kg/ADt	SS kg/ADt	Site-specific DO in receiving water outside mixing zone	Acute toxicity of effluent for standard discharge volume of 175 m^3/t pulp	Sublethal toxic effect beyond the mixing zone	Organo-chlorines kg TOX/ ADt
I	>30	>15	DO is at low level of protection or worse	LC50<50%	yes	≥5.0
II	<30/16.5	<15	DO meets low level but not moderate level of protection	LC50>50%	yes	<4.5
III	<30/16.5	<10	DO meets moderate level of protection	LC50≥100%	none	<2.5
IV	<30/16.5	<10	DO meets high level of protection	LC50≥100%	none	<1.5

Note:

1. ADt = Air Dried tonne. The term "Air Dry" signifies 90% dry fibre and 10% moisture (1 ADt = 900 kg oven dry pulp).
2. BOD = Biochemical Oxygen Demand is a property of water or wastewater, determined by measuring the quantity of oxygen consumed by a sample under controlled conditions for a defined time period.
3. DO = Dissolved oxygen, normally measured in milligrams/litre and widely used as a criterion of receiving water quality.
4. LC50 = The LC50 of an effluent sample is an estimate of the concentration of that sample that will kill 50% of a group of fish immersed in that concentration for a specified length of time. (E.g., for the trout toxicity test, a 96-hour LC50 of ≥100% estimates that no more than 50% of a group of fish exposed to full strength effluent for 96 hours have died in the test; and an LC50 of 50% estimates that 50% of a group of fish exposed to 50% effluent have died in the test.)
5. Sublethal = A concentration or level that would not cause death, but will have long-term deleterious effects.
6. Suspended solids = Particles of matter suspended in the water.
7. TOX = Total Organic Halogen measured by analytical procedure and defined in APHA, et al. (1985).

The authors conclude that most Ontario mills, currently at Levels 1 or II, can achieve Level III within three years at little real cost. By achieving Level III, the total discharge of organochlorines (measured as TOX) would be reduced, on average, by at least 50 percent and mills would produce an effluent that is non-lethal to fish given the dilution factor allowed in the report.

As the cost of achieving Level IV would be much higher, the authors of the report recommend a time frame of at least five years to reach it. This period would allow mills the opportunity to make the many changes to bleach plants, and also provide time for research into better means of attaining or improving this high level of environmental protection.

The authors indicate that the levels provide a framework for identifying the current status of mills and quantifiable measures for improvement. They recognize the Ministry's responsibility to choose acceptable goals and timelines for achievement. They also strongly recommend that the industry be allowed to choose the technology required to meet those goals.

REVIEW OF "KRAFT MILL EFFLUENTS IN ONTARIO" REPORT

Public Review

The Kraft Mill Effluents in Ontario report was released to the public on April 15, 1988, for a 30 day review period. Nine submissions were received: seven from industry, one from a consultant and one from the MISA Advisory Committee.

The industry generally supported the approach to pollution abatement recommended in the report. Some concerns were raised, however, on the tight timing and limits for controlling organochlorines. The consultant who submitted comments on the report felt that there were benefits from the use of external treatment facilities in addition to those identified in the report. The MISA Advisory Committee supported the goals identified by Level IV in the report, but found criticisms of the MISA program in the report unwarranted.

The Ministry reviewed all public comments and compiled a list of the issues raised. These issues and the Ministry's responses are presented in Appendix B of this report.

Ministry's Review

The far-reaching implications of the Kraft Mill Effluents in Ontario report required a broad forum of discussion within the Ministry. Accordingly, the review was conducted by MISA staff, Ministry regional staff, other branches of the Ministry and the Ministry's Pulp and Paper Policy Committee.

The Ministry also benefited from the nine submissions received from the public.

Appendix A of this report presents the Ministry's position on 20 specific issues raised by the Kraft Mill Effluents in Ontario report. The remainder of this document presents an overview of the Ministry's position.

THE MINISTRY'S POSITION

In formulating a control program for kraft mills, the Ministry accepted the general intent and direction provided by the Expert Committee in the Kraft Mill Effluents in Ontario report. Specifically, the Ministry is calling for the systematic reduction of toxic chemicals leading to the virtual elimination of persistent toxic substances from mill discharges under the MISA program. Also, it will require kraft mills to take immediate abatement action under an interim strategy that will be enforced until the MISA discharge limits regulation is issued.

More stringent controls than those called for in the report will be imposed on conventional pollutants. The report states that these compounds can be diluted in receiving waters to an extent that they pose no immediate threat. The Ministry's position, however, is that public's waterways can no longer be used for disposal of inadequately treated industrial waste. Also, the treatment used to control conventional pollutants will remove some of the chlorinated organics and acutely toxic compounds. Thus, these measures will contribute to the ultimate goal of virtual elimination of persistent toxic substances.

The Ministry's position on the fish test for acute toxicity is also more stringent than that provided in the report. To determine the lethality of effluent, the expert committee recommended applying water use credits -- in effect this would allow eight of nine mills to dilute their effluent before testing it. Under MISA, these water use credits will not be permitted. Undiluted mill effluent must be non-lethal to fish.

The Ministry will also consider setting discharge limits for chlorinated organics at levels lower than those recommended by the Expert Committee. Limited monitoring data on these chlorinated organics levels in Ontario kraft mill effluents has recently become available. (Appendix C) These data indicate that it may be practicable for the mills to achieve lower levels.

Finally, the Ministry supports the report's recommendation for site-specific limits. Therefore, more stringent limits may be imposed in situations where this is required to protect the local environment.

The Control Program

Under the MISA program, a regulation will be developed requiring kraft mills to meet discharge limits based on the best available technology economically achievable (BATEA). BATEA limits will be imposed on the parameters identified in the Kraft Mill Effluents in Ontario report (Table 1) and on any other compounds that are determined to be hazardous for which control technology exists.

It is premature to fix numerical values for BATEA at this time. The Ministry will be taking the MISA monitoring data, recommendations from the joint technical committee for this sector and will conduct further reviews of the Scandinavian studies, as well as other data bases. Some of the values, however, identified as level IV in the Expert Committee Report provide a starting point for discussion. The limits that are arrived at through discussion will be subject to public review.

The Ministry has, however, established the criteria for determining acute lethality -- one of the requirements to be imposed under the abatement regulation. Undiluted mill effluent will be tested and it must prove non-lethal to fish.

Consistent with other MISA initiatives and expert committee recommendations, the kraft mills will be free to choose how to achieve the specified limits. The options include manufacturing process changes, substitution of chemicals, recycling of waste by-products and end-of-the-pipe treatment. The Ministry recognizes that the first three options offer opportunities for profit improvement and better pollution control. It will continue to encourage and work with industries to move in this direction.

The MISA limits regulation will be promulgated in 1991; mills must be in compliance by 1993. The MISA goal of virtual elimination of persistent toxic contaminants will be achieved for kraft mills through this and successive application of more stringent BATEA-based limits.

However, the Ministry is also concerned that effective controls are put in place now to safeguard the environment until more comprehensive and stringent regulatory measures are imposed. The Expert Committee's recommendation for immediate abatement action was therefore most timely. The Ministry has developed an interim control strategy after considering the experts' findings.

Control Orders, to be issued in 1989, will require kraft mills to achieve a modified level III from the Kraft Mill Effluents in Ontario report (Table 1). The Ministry will seek the maximum pollution reduction that is practicable from each kraft mill within the time frame of the Control Order. The chemical limits so derived will be at least as or more stringent than those identified in Level III. Also, no mill will be allowed to backslide from current operating performance.

The Control Orders will also specifically address acute lethality. Under the Control Orders, mills will be required to submit a plan for Ministry approval. Mills must identify, in these plans, the abatement measures they will take to render their effluent non-lethal to fish by 1993. The Ministry will monitor mill activities to ensure performance benchmarks are reached and will take action against mills that are out of compliance with their approved plan.

Appendix D provides a standard control order. This generic control order will serve as the basis for development of the specific control order for each of Ontario's kraft mills.

The Ministry concurs with the authors of the report that the threat posed by kraft mill effluent to the aquatic environment warrants this approach. Furthermore, proven and practical technology to achieve Control Order limits is available. In fact, some mills are currently operating with process and treatment technologies that, with little or no upgrading, will likely achieve the limits identified as Level III (Appendix C).

Nevertheless, the Ministry will seek from all mills the maximum pollution reductions that are practicable within the time frame of the Control Order. The industry as a whole can be assured that application of these technologies will not only gain significant improvements at present, but will also serve as the foundation for further abatement action which will be required under the limits regulation.

The Control Orders will apply until the MISA limits regulation comes into effect, and mills will be required to monitor their effluents for compliance with the limits specified in the control orders.

Additional monitoring will be required starting in the fall of 1989. At that time, the MISA monitoring regulation for the Pulp and Paper Sector will come into effect. Under the regulation, kraft mills will be required to monitor their effluents for conventional and toxic pollutants. The quality control and reporting guidelines specified for all MISA monitoring will be followed. The industry and Ministry will also conduct open-scan effluent characterizations. The data gathered as a result of this monitoring will be used to help formulate the discharge limits regulation.

Other Jurisdictions

The Ministry's strategy provides an equitable approach to the significant challenge posed by kraft mill effluent. The Kraft Mill Effluents in Ontario report describes Ontario's mills lagging behind mills in other jurisdictions in pollution control. In the last four years, for example, mills in the United States have

reduced effluent toxicity below Ontario levels and discharge only one-quarter of the BOD per tonne of pulp as that discharged by comparable Ontario mills.

In Sweden, the emphasis in pollution control has moved to chlorinated organic compounds. Discharge limits issued to mills currently require them to reduce the discharge of these pollutants to 1.5 kg. TOCL/tonne pulp, which is similar to the reduction called for in level IV in the Kraft Mill Effluents in Ontario report.

Germany is introducing stricter regulations in 1989. Although there are no kraft mills operating in Germany, the current fee structure imposed on discharges, if applied to Ontario mills, would cost a small mill somewhere between one-half to one million dollars per year.

Finally, the report notes that Ontario's producers have been treated more generously in terms of tax and/or subsidies when compared with Scandinavian and United States producers.

The Ministry's strategy, then, is based on the understanding that the kraft mill industry can afford to cleanup its toxic wastes. Effluent limits should not cause undue financial hardship for Ontario's mills and, in fact, can result in cheaper operating costs.

Compliance costs will vary considerably across the mills. Costs to meet the proposed requirements are dependent upon existing technology employed by the mill and past efforts and investments made to improve effluent quality. Those mills that have made little or no effort in the past will face the higher costs. In

most cases, capital expenditures can be at least partially recovered through resulting operating cost reductions. Consultations with the mills concerned indicate that they are prepared to cooperate in making pollution control improvements.

APPENDIX A

MINISTRY'S REVIEW OF 20 SPECIFIC ISSUES

RAISED BY KRAFT MILL EFFLUENTS IN ONTARIO REPORT

INTRODUCTION

In the course of the Ministry of Environment's review of Kraft Mill Effluents in Ontario report (KMEO), a number of important issues were identified for thorough study and discussion. These issues are important not only to the ministry's strategy for controlling kraft mill pollution, but also to the MISA program overall and its application across all sectors. The issues are presented in the same order as they appear in the first section of KMEO.

Reference is made in each discussion to the relevant recommendation made by the expert committee in KMEO.

A.0 ISSUES

A.1 Recommended Goals (KMEO, 1.2.1 and Table 1.1)

The report recommends that mills should reach one of the levels of achievement presented in the Table 1.1 (reprinted on page 10 of this report).

Ministry Position

Although in general agreement with the report's goals and approaches, the ministry does not agree with the recommended limits for certain parameters. Some of these limits are based on out-dated control concepts, technologies and federal regulations issued in 1971. The ministry has established a process under the MISA program for setting discharge limits based on the best available technology which is economically achievable, in the context of today's conditions.

The process of determining BATEA for each industrial sector and the municipal sector consists of the following major steps: consultation with each industrial sector through joint technical committees; review of available data from

various studies, monitoring programs and similar regulations in other jurisdictions; completion and review of economic impact studies; the recommendations of the MISA Advisory Committee; and public review of regulations and supporting studies. Only through this rigorous process will the ministry identify and set BATEA discharge limits.

Therefore, the ministry will not necessarily adopt the limits recommended by the expert committee. The ministry will develop limits in accordance with up-to-date pollution control concepts and approaches. The ministry regards the limits provided by the expert committee as a good reference framework to begin this exercise.

A.2 Establishing BOD Discharge Limits (KMEO, 1.2.2)

The specifications in Table 1.1 regulate BOD discharges according to 1971 federal standards and by defining acceptable dissolved oxygen levels in receiving waters.

Ministry Position

Federal standards of 1971 were developed using information obtained in the late 1960's, and have not been revised since initial promulgation even though the federal government considered revisions in the early 1980's. United States Environmental Protection Agency (US EPA)standards for new source mills are considerably more stringent, and will be considered as levels for all mills in Ontario to meet in the 1990's.

The report argues that BOD is of secondary concern providing it does not create a dissolved oxygen problem. It states that setting more stringent standards could deter the installation of in-plant technology which would satisfy other requirements (toxicity and organo-chlorine requirements), but may not meet the more stringent BOD requirements.

The view that receiving waters can be used to treat waste discharges is no longer acceptable to the ministry. The notion that "dilution is the solution" is contrary to the fundamental concept of MISA.

Other classes of dischargers, including small municipalities, have BOD discharge levels far below those discharged by kraft mills. All dischargers in the province will be required to make substantial reductions once BATEA limits are established under MISA.

Less stringent requirements for BOD can be incorporated into control orders for the short term and thereafter, MISA BATEA limits will prevail.

Therefore, the ministry intends to set more stringent control on BOD discharge than the 30 kg/tonne recommended in table 1.1 for level III limit to be achieved no later than December 31,1991. The ministry considers the 16.5 kg/tonne level to be an appropriate interim target. Mills will not be allowed to backslide from their present level of discharge.

For level IV, the ministry anticipates, at this stage, that the US EPA standard for new source mills of 5.5 kg/tonne will be appropriate.

However, it must be stated again that discharge limits will be set by the BATEA process established under MISA.

A.3 BATEA (KMEO, 1.2.3.)

The report argues that BATEA is inappropriate because it is synonymous with secondary treatment which is neither desirable nor justifiable. The report further argues that BATEA is neither technically sound nor environmentally useful for the 1990's.

Ministry Position

Under MISA, all dischargers are free to choose how they will meet discharge limits. Options may include: manufacturing process changes, substitution of chemicals, recycling or reusing waste, and end-of-pipe treatment. The process of deriving BATEA will provide a numerical effluent limit; the ministry will not dictate what specific technology dischargers must use to meet BATEA limits. The assertion that every mill will be forced to install secondary treatment, or the same type of treatment technology, is unfounded.

BATEA is fundamental to the MISA program as described by the MISA White Paper, June 1986. The application of sector-by-sector limits based on BATEA follows from the principle that the best pollution control technology for one sector may not be technically effective or economically feasible for other sectors. By setting standards based on BATEA for each sector, rather than a single standard for all sectors, the province will achieve a better overall level of protection reflecting the diversity of industrial wastewaters, processes and products in Ontario. BATEA, in short, will provide equitable, fair and tough regulations.

The ministry will continue to develop limits regulations on the basis of BATEA. The water quality impact assessment will subsequently be used on a site specific basis to determine whether more stringent requirements are necessary to protect the local receiving environment.

A.4 BOD vs Organochlorine (KMEO, 1.2.4)

The report recommends that BOD not be treated as a "catch-all" for organic waste discharges and that the emphasis should be directed to organochlorines. It argues further that measures to reduce organochlorines will cut emissions of traditional pollutants.

Ministry Position

The ministry agrees with the emphasis on organochlorine reduction.

The control of organochlorines is a recent concept originating in Sweden. The technologies for reducing the formation of organochlorines involves the diminished use of chlorine. The ministry recognizes that there may be reductions in BOD levels from using these technologies, but it is not confident that these reductions will be sufficient to provide the level of protection demanded by MISA.

The ministry realizes that the bulk of the persistent toxic compounds associated with kraft mill effluents are contained within the group of organochlorine chemicals. However, other non-chlorinated toxic compounds associated with kraft mill discharges, (e.g., resin acids and fatty acids) are of concern and will not necessarily be addressed by organochlorine reduction technologies. These non-chlorinated toxics can be reduced by methods used to control BOD.

Therefore, the ministry accepts the expert committee's recommendation to emphasize reductions in chlorinated organics. However, this will not be done at the expense of controlling BOD. The ministry will continue to use BOD as a useful environmental parameter and not switch the emphasis of its program solely to organochlorine reduction.

A.5 Parameters to Control Organochlorine Discharges (KMEO, 1.2.5)

The report recommends that the ministry adopt a policy of regulating total organic halogen discharges and that the levels should be the same for all mills regardless of wood species and bleaching processes used.

Ministry Position

The ministry will develop a limits regulation for organo-halogen discharges based on an AOX measuring parameter. The discharge limits will be independent of types of wood and bleaching processes.

There are a number of parameters in use and the ministry is just completing a protocol for AOX, absorbable organic halide, which is a refinement of the TOX method as described in the APHA's Standard Methods.

The ministry favours the AOX protocol because the test is simpler than the TOX protocol, and there is general movement among Europeans and North Americans toward adoption of an AOX test.

The report recommends that the ministry allow the use of the Germgard equation to calculate TOX levels. This equation indicates that TOX is produced in proportion to the amount of chlorine used. Although being opposed to secondary treatment, the report points out that the Germgard equation does not give credit for any reductions achieved by secondary treatment and that reductions across treatment systems should be evaluated by analysis.

From a regulatory standpoint, the use of a mathematical approach to regulating TOX has significant legal problems. A direct, chemical analysis approach, on the other hand, would appear to be problem-free. For these reasons, the ministry would prefer to develop a data base through a monitoring regulation, using the AOX approach, and then establish regulatory discharge limits for AOX, consistent with the overall MISA approach.

There is currently insufficient data on which to establish AOX levels although it is known that AOX analysis yields

levels approximately 5% lower than corresponding TOX analyses. Given this minor difference, the levels recommended for TOX in table 1.1 are applicable to AOX.

The Ministry will complete the protocol for AOX, and a data base for AOX discharges from Ontario kraft mills will be developed under a monitoring regulation. Although the Expert Committee recommends the limit of 1.5 kg AOX/tonne of bleached kraft pulp for level IV, the final level under the effluent limits regulation will be set by the BATEA process established under MISA. Dischargers must meet the regulation limits by 1993.

In the interim, Control Orders will be issued. The Ministry will seek maximum AOX reductions that are practicable from all kraft mills within the time frame of the Control Order. The limits so derived will be at least as or more stringent than the 2.5 kg AOX/tonne level recommended by the Expert Committee. Dischargers will be required to meet these limits by 1991.

A.6 Chloroform (KMEO, 1.2.6)

The report recommends the investigation of chloroform concentrations in the ambient air around kraft mills using hypochlorite in their bleach cycle.

Ministry Position

The use of hypochlorite in pulp bleaching is reported to be the major source of chloroform generation. Seven of the nine kraft mills in Ontario currently use hypochlorite in their bleaching sequences.

Chloroform was consistently found in mill effluents during the pre-regulation monitoring program, and would likely

volatilize substantially as effluent passes through treatment systems such as an aerated lagoon.

The ministry's Air Resources Branch will develop a chloroform monitoring program for ambient air in the vicinity of mills and aerated lagoons. As well, chloroform will be monitored in the effluents.

Furthermore, measures to reduce TOX should decrease chloroform formation, as well.

A.7 Control Parameters for Toxicants (KMEO,1.2.7)

The report recommends that TOX be used as the major control parameter for toxicants in preference to the MISA approach of specifying discharge limits for a potentially large number of compounds.

The report argues that establishing limits on the basis of a list of specific substances is environmentally dangerous and likely to lead to an ever increasing list of regulated substances with an increasing associated cost.

Ministry Position

The ministry recognizes the value of a generic parameter, but also recognizes that specific toxic compounds may not be adequately reduced by controlling a generic parameter.

In practice, the list of individual, chlorinated compounds in kraft mill effluents for which analytical protocols exist is relatively small and the generic approach to control is the most probable route at this time. The ministry also plans to specify key parameters on a 'as needed' basis in addition to AOX.

The ministry will develop a limits regulation for the generic AOX parameter, but will also continue with its program of developing analytical protocols for individual chlorinated chemical compounds that are found to be of concern after EMPPL (Ontario Effluent Monitoring Priority Pollutants List) screening.

A.8 Determination of Organochlorines (KMEO, 1.2.8)

The report recommends that debate over appropriate control parameters should not delay regulation development. The report recommends use of the mathematical approach (Germgard equation) as an interim approach.

Ministry Position

The Germgard Equation and its limitations were discussed earlier. The ministry is concerned that this mathematical approach could be easily challenged in court. Furthermore, the Germgard Equation, which indicates the quantity of chlorinated organics being produced, does not accurately reflect the quantity discharged. In particular, it does not account for reductions in chlorinated organics due to treatment or adsorption by pulp. In addition, preliminary data from MOE, Environment Canada and industry for Ontario kraft mill effluents indicate that the Germgard Equation over-estimates the quantities of chlorinated organics that are being generated.

The ministry will proceed to develop a limits regulation for AOX under the MISA program.

A.9 Organochlorines in Pulp (KMEO, 1.2.9)

The report expresses concern that mills may use the adsorptive properties of pulp as a means of reducing the

levels of organochlorines in effluents. The report recommends the use of suitably worded control orders to prohibit this.

Ministry Position

This issue arises because dioxins and dibenzofurans are readily adsorbed by solid materials such as pulp fibres.

Consumer demand for dioxin and dibenzofuran free pulps will likely deter mills from relying on this adsorptive quality to meet effluent limits for these two classes of compounds.

It is unlikely that substantial effluent reductions in AOX could be achieved by adsorption since the concentrations are too high.

Although appreciating the report's concerns, the ministry does not consider the adsorption issue to be of major significance and does not believe control is warranted.

The responsibility for regulating dioxins in consumer products rests with federal and provincial ministries of consumer affairs and health. The Ministry of Environment will ensure these agencies are aware of this issue.

A.10 Research on Chlorine-Free Bleaching (KMEO, 1.2.10)

The report recommends that the ministry should actively support any mill that wishes to explore chlorine-free bleaching. The report also recommends that the ministry should protect these mills from prosecution if limits are not met due to failure of the research.

Ministry Position

The ministry supports any such research conducted by a mill, and may provide financial assistance. The ministry also supports any other research to develop ecologically clean technology.

However, all research proposals would be subject to ministry approval. If exemption from prosecution is allowed in some cases, the ministry will insist that projects be conducted according to schedule, and that milestones be identified so that the ministry can monitor progress.

The ministry will promote and support research into chlorine-free bleaching. When the ministry agrees to a research project, provision against possible prosecution for failure to meet effluent limits, in the event of failure of the research, will be made.

A.11 Selection of Appropriate Technology (KMEO, 1.2.11)

The report states that mills should be allowed to select the technology by which they intend to comply with discharge limits.

Ministry Position

As discussed previously, BATEA will be defined in terms of effluent limits. **Dischargers are free to choose how they will meet the limit. The ministry has no intention of dictating what technology must be used.**

A.12 Toxicity Tests (KMEO, 1.2.12)

The report recommends that toxicity testing be done on the basis of a standardized water consumption level per unit of

production for all mills. This can be accomplished by physical dilution of the sample(s) or mathematically. The report argues that mills that have embarked on water conservation programs are penalized because their effluents are more concentrated and, therefore, more toxic.

The report argues that an approach which does not allow the uniform application of a water credit will discourage mills from conserving water. The report also says that such an approach will encourage the use of as much water as possible and discourage the development of environmentally desirable technologies such as oxygen bleaching.

Ministry Position

The ministry considers water conservation and toxicity as two separate issues, both of which are important.

Water conservation is motivated by economic concerns. Conservation means less in-coming water to treat and a smaller effluent volume to treat before discharging. Therefore, the cost of treatment is reduced.

Even with the water reduction programs that have taken place, flows in the industry range from 50,000 to 200,000 cubic metres per day which makes the mills among the highest water users in the province.

The ministry is strongly opposed to the use of water credits for MISA monitoring purposes because it is important to determine the toxicity of the wastes as they are being discharged from each outfall. Also, acute toxicity tends to be caused by concentration rather than the loading factor.

Under MISA discharge limits, this industry will be required to have an effluent which is non-lethal to fish, with no allowance for water credit.

The Ministry recognizes the time dischargers need to meet this stringent requirement. Therefore, a staged process will be followed. Mills will develop and submit plans identifying the successive steps they will take to achieve an undiluted effluent that is non-lethal to fish by 1993. The Ministry must approve these plans and will subsequently monitor mill activities to ensure performance benchmarks are reached. The Ministry will take action against mills that are out of compliance with their approved plan.

A.13 pH in Toxicity Tests (KMEO, 1.2.13)

The report recommends that all toxicity testing should be conducted on effluents adjusted to pH = 7, or to the value of the receiving water. This adjustment would mean that the pH levels in effluent would not be a factor in the discharger's ability to pass or fail the toxicity test.

Ministry Position

Artificially altering pH by using chemicals prior to toxicity testing may substantially alter the chemical structure and reduce toxicity of the effluent sample by as much as one-half in some cases. As a result, the toxicity of the adjusted sample is not representative of the toxicity of the effluent discharged to the environment. **Therefore, adjustment of pH will not be allowed prior to toxicity testing.**

Also, inclusion of the pH factor will provide the ministry with valuable information. The acute toxicity test is conducted at several levels of dilution, in addition to full strength. The series of dilution steps simulates the natural process of effluent neutralization in the receiving water. Hence, the test will identify the dilution level at which the pH factor becomes insignificant. All this information will be useful in setting site-specific discharge limits to protect the local environment.

Industry will be required to perform toxicity tests with no pH adjustment, and encouraged to perform parallel toxicity testing with pH adjusted effluent samples for comparative purposes, and to build a data base.

A.14 Rapid Toxicity Testing (KMEO, 1.2.14)

The report recommends that the ministry should encourage the use of rapid bacterial testing as a means of finding sources of toxicity and as an acceptable way of routinely reporting toxicity.

Ministry Position

The ministry has assessed a variety of short-term microbial acute toxicity testing procedures. While such tests may be useful for monitoring in-plant controls and changes, they are not an adequate substitute for rainbow trout and daphnia toxicity testing of effluents.

These microbial tests usually reflect sub-lethal effects on marine bacteria and, as a consequence, are not relevant to Ontario's fresh water lakes and rivers. Furthermore, it is difficult to relate the results from the bacteria test to results from the trout and daphnia tests. It is also difficult to make direct extrapolations from the sub-lethal test data to the overall impact on the environment.

The ministry will consider any new evidence demonstrating the reliability of the sub-lethal test and its relationship to the trout and daphnia tests. **Until such evidence becomes available, the ministry will require that effluent toxicity testing for regulatory purposes be limited to traditionally accepted testing procedures using fish and daphnia.** However, the ministry will encourage industry to use short-term microbial testing for in-plant control purposes as an aid to managing toxicity in effluent discharges.

A.15 Absence of Sub-lethal Effects (KMEO, 1.2.15)

The report recommends that a policy or regulation be adopted which requires no overt sublethal effects of kraft mill effluent beyond the mixing zone, with regular auditing. The report also recommends that the genotoxicity of effluents be tested on a routine basis.

Ministry Position

The ministry's surface water management policies currently call for no sub-lethal effects in the receiver at the boundary of a mixing zone. The discharger meets this requirement by complying with the provincial water quality objectives at that point.

The ministry is also developing laboratory test procedures for assessing sub-lethal effects such as reproduction impairment, hatchability and growth inhibition for a variety of life forms. Mutagenicity of effluents is also being addressed through the development of laboratory and field procedures.

Sub-lethal effects testing is not being incorporated into the first phase of the MISA discharge limits regulations; these discharge limits are based on BATEA. Such testing will, however, be applied in subsequent water quality impact-based MISA requirements.

The ministry will continue to develop sub-lethal toxicity testing procedures for use in the laboratory and field. These procedures may be used in subsequent water quality impact-based phase of the MISA program.

A.16 Phosphorus (KMEO, 1.2.16)

The report recommends that phosphorus discharge limits should allow for the phosphorus that is present in the wood and in make-up chemicals, and also the phosphorus added to biological systems for proper operation.

Ministry Position

The ministry is requiring reductions in phosphorus levels to 1 ppm or below at most municipal sewage treatment plants and industries discharging to the Great Lakes. Pre-regulation monitoring data indicate that phosphorus levels in mill discharges are generally below the 1 ppm level, and that phosphorus levels in mill discharges are not expected to be a problem.

The limit for phosphorus discharges in mill effluents will be established at the 1 ppm level unless ongoing monitoring data indicate a need to consider a lower level.

A.17 Effluent Outfalls (KMEO, 1.2.17)

The report recommends that mills be required to install outfall systems that eliminate foam, visible colour and other undesirable aesthetic effects; calculations on the allowable BOD discharge should include the effect of the outfall system.

Ministry Position

The ministry already has an established policy which requires the elimination of undesirable aesthetic effects.

However, the inclusion of the effect of the outfall system in the calculations for allowable BOD discharges for mills is,

in effect, treatment in the waterway. The ministry opposes treatment in the waterway.

The ministry does not consider outfall diffusers to be treatment systems. Allowable levels of BOD discharge will be developed on the basis of available technology, both for the purposes of MISA limits regulations and for control order requirements.

A.18 Spill Control (KMEO, 1.2.18)

The report recommends that control orders require mills to install an effective spill monitoring and alarm system and sufficient storage to minimize the risk to the environment.

Ministry Position

The ministry is already requiring some degree of spill control at mills as part of control order requirements.

The MISA limits regulations will likely address this issue under a requirement for "best management practices", which will most probably be applied in a generic sense rather than mill specific. The ministry will ensure that future control orders or control order revisions incorporate the requirements.

A.19 Control Orders (KMEO, 1.2.19)

The report recommends that control orders or other regulatory instruments be issued for a period of five years.

The report argues that mills be given a sufficient length of time to plan and implement major changes. The report also considers that industry should not be subjected to frequent changes in effluent quality requirements.

Ministry position

The ministry agrees that mills require time to plan and implement major changes, and also agrees that effluent requirements should be imposed without frequent changes. However, given the urgent need to protect the environment, control orders will be issued in early 1989; mills must be in compliance by 1991. In 1991, the MISA discharge limits regulation, requiring more stringent abatement, will be issued; mills must be in compliance by 1993.

A.20 Suspended Solids (KMEO, 1.3.5)

The report suggests that suspended solids are inconsequential at most mills in Ontario and even where large quantities are being discharged, suspended solids are not causing significant problems.

Ministry Position

The ministry considers that suspended solids, along with other pollutants, should be reduced at source with the best available technology economically achievable.

The ministry guideline for suspended solids discharges from the pulp and paper industry was set in the late 1960s at 50 ppm. This was a considerable departure from the general guideline for industrial waste discharges which was 15 ppm.

The 50 ppm guideline was based on the concept of settleable solids and implied the installation of best primary treatment available at that time.

Federal guidelines for suspended solids were established in 1971 and were based on similar principles, but they were set based on production rate.

US EPA requirements for new source performance standards are lower than Canadian federal requirements.

The ministry will review the level III suspended solids presented in table 1.1 (KMEO) to determine whether they are appropriate for inclusion in the control orders mentioned above. BATEA limit for suspended solids will be developed for inclusion in the MISA limits regulation.

APPENDIX B

ISSUES ARISING FROM PUBLIC REVIEW

OF THE KRAFT MILL EFFLUENTS IN ONTARIO REPORT

BACKGROUND

On April 15, 1988, the Minister of the Environment released Kraft Mill Effluents in Ontario report to the public for review and comment. The review period ended on May 15, 1988.

Over 1000 copies of the report were sent to a portion of the MISA mailing list and to those who requested copies. The ministry received nine formal responses from the following: The Ontario Forest Industries Association; Abitibi-Price Inc.; Boise Cascade Canada Ltd.; Great lakes Forest Products Limited; James River-Marathon, Ltd.; C.I.L Inc.; Microbics Enterprises; Sandwell Swan Wooster Inc.; and The MISA Advisory Committee.

The responses addressed a number of concerns and issues, many of which were common to all parties. The ministry has compiled a list of these issues and prepared a response to each one.

The concerns and issues fall into a number of categories: levels of achievement; best available technology economically achievable; organochlorine discharges; TOX/TOCL; Dioxins; oxygen delignification; toxicity; and economics.

LEVELS OF ACHIEVEMENT

Comment 1: (Industry)

Industry supports the recommendation for a series of compliance levels to be achieved in a set period of time, however, industry maintains that it should be free to choose the technology that it will use to comply with regulations.

Response:

The ministry has accepted the report's recommendation that a series of compliance levels be established for regulatory purposes and agrees with industry choosing the technology it will use for complying with regulations.

Comment 2: (Industry)

Industry concurs with the levels for some of the parameters as set out in table 1.1, and the rationale supporting these levels but expresses concern over the specific levels relating to sub-lethal toxic effects and whether the levels recommended for TOX can be achieved with current technology.

Response:

Sub-lethal effects testing is not being incorporated into the first phase of the MISA discharge limits regulations; these discharge limits are based on BATEA. Such testing will, however, be applied in subsequent water quality impact-based MISA requirements.

The authors are confident that the recommended levels for TOX can be achieved by Ontario mills with technology which is currently available. Many mills in Scandinavia are already meeting the level III TOX limit and there are indications that some mills in Ontario are also meeting the limit. There is no doubt that some mills will have to substantially upgrade their operations in order to meet level IV.

The authors also recommended that support be given to the development of new and more cost-effective technologies to achieve these TOX levels. The ministry concurs with this view, and will encourage research and development in this area.

Comment 3: (Industry)

Currently, there is insufficient information on receiving water requirements and process development regarding organochlorines to determine whether or not level III and/or level IV are applicable or necessary in Ontario. It is further submitted that there is no scientific evidence which relates organochlorine effluent discharge levels with effects on the environment.

Response:

In general, organochlorines are known to be persistent in the environment and toxic to aquatic life. Recent studies in Sweden indicate that organochlorines bioaccumulate in fish and adversely affect the reproductive cycle and liver function of fish. Ontario data shows that dioxins and furans are found in kraft mill effluents, and they are also found in fish taken downstream from kraft mills. For these reasons, the ministry believes that a reduction in organochlorine discharges to the environment is necessary, and is consistent with the MISA goal of eliminating persistent toxic substances.

Comment 4: (Industry)

It must be remembered that certain mills in the province have made significant commitments of capital, process and human resources to improve environmental performance, while others have not. The government should require all kraft mills to achieve a minimum standard of environmental performance before requiring further action by those that took the lead.

Response:

The ministry will establish a phased program for all mills which will require compliance with limits set out in the

Control Orders as the first phase. The second phase will require compliance with limits set out in the MISA effluent limits regulation. All mills will be expected to meet the same standards by 1993.

Comment 5: (Industry)

Industry suggests that the report is an excellent starting point on which to base further discussion but is not, however, a comprehensive analysis on which the government can base specific policy actions without putting at risk much of the pulp industry in northern Ontario.

Response:

The ministry considers the report as one of many tools which will be utilized in establishing policy and developing regulations.

The ministry is confident that the immediate steps required under a control order will not put the pulp industry in northern Ontario at risk. Future limits imposed under MISA will be derived through a process involving consultation with the public and industry and will include a comprehensive economic assessment.

BEST AVAILABLE TECHNOLOGY (BAT)

Comment 1: (Industry)

Industry is concerned that the BAT approach may be applied blindly and mills will be required to spend a large amount of money for end-of-pipe treatment when in-plant controls or process modification will be just as effective at a reduced cost.

Response:

The ministry will develop a "BAT model" for the purpose of establishing effluent limits. Although the model will be based on the use of certain technological components, industry will be free to select the appropriate technology route by which it intends to comply with these limits. As mentioned previously, the ministry will follow a process for deriving BATEA, as discussed in the MISA White Paper (1986) and outlined on page 20 of this document.

Comment 2: (MISA Advisory Committee (MAC))

MAC believes that industry should be required to install secondary treatment to address BOD, suspended solids, TOX, and toxicity reduction, and also to install adequate retention capacity to prevent spills impacting on the environment.

Response:

The ministry accepts these comments under advisement but as stated earlier, the ministry will allow industry the option of selecting the technology or technologies to be used in order to comply with the limits.

Comment 3: (Industrial Consultant)

The report seems to downplay the benefits of aerated lagoons in preference to oxygen delignification. A well designed and operated lagoon can achieve the same reduction in TOX as oxygen delignification. Additionally, oxygen delignification doesn't enjoy the many side benefits associated with a properly operated aerated lagoon, such as taste and odour reduction, smoothing out of surges in effluent quality, and elimination of acute toxicity and chronic toxicity.

Cost considerations aside, aerated lagoons generate more environmental benefits than oxygen delignification.

Response:

The ministry accepts this comment and strongly supports the use of aerated lagoons. However, where they are not cost effective, the Ministry is prepared to accept other technologies provided they can be demonstrated to meet the limits. Where aerated lagoons are not installed, the Ministry will require the installation of effective spill prevention measures to minimize effluent surges.

Comment 4: (Industrial Consultant)

The report's recommended TOX numbers assume oxygen delignification technology will be applied. It may be better from many standpoints (environmental, economics, R&D, etc.) to slightly relax the recommended TOX values and encourage a form of extended delignification rather than oxygen delignification.

Response:

The report acknowledges that other technologies such as extended delignification are available and also suggests that these may be viable alternatives to compliance with the TOX levels recommended.

ORGANOCHLORINE DISCHARGES

Comment 1: (Industry)

The ministry should assess all the various methods for organochlorine measurement before the limit is set.

Response:

The ministry has completed a survey of the available methods for organochlorine determination. The "Absorbable Organic Halogen" test, (AOX) which is a refinement of the U.S., APHA TOX method, has been determined to be the most appropriate test method for use in Ontario and the ministry will be issuing the test protocol shortly.

Comment 2: (Industry)

The ministry should recognize that organochlorine levels from hardwood mills will be significantly lower than organochlorine levels from softwood mills. When the limits are developed they should be based on softwood, not hardwood.

Response:

The ministry recognizes that there are differences in organochlorine levels from hardwood and softwood bleaching operations. The report recommends levels which are based on softwood pulp bleaching, but as data become available from the MISA Monitoring program, they will be evaluated to determine whether different limits should be established and can practically be enforced for the two types of wood.

Comment 3: (Industry)

Industry disagrees with the use of the "Germgard" formula for mathematical determinations of organochlorine levels because the formula doesn't take into account removal of organochlorines by primary or secondary treatment, nor does it agree with actual data all the time.

Response:

The Ministry does not support the use of the "Germgard" formula for regulatory purposes, and does not recommend that mills use the formula to estimate the level of organochlorine discharges for control planning purposes.

Comment 4: (Industry)

Industry disagrees with Table 1.2 which states that biological treatment can reduce organochlorine levels by up to 33%. This might be true for levels at the 8-10 kg TOCL/ tonne but it is not known if it holds true at the 1.5 - 2.5 kg TOCL/tonne level.

Response:

The ministry agrees that the 33% removal figure is based on limited data and that confirmatory data will be needed before this figure can be used for regulatory purposes. In fact, recently available data indicate removal of as high as 50% is being achieved.

Comment 5: (Industry)

The report acknowledges a lack of strong evidence relating toxicological problems in the receiver to bleached kraft mill effluent discharges and Sweden has stated that "... in spite of extensive investigations, a clear-cut relationship between the release of chlorinated organic material and biological/ ecological effects in the receiving water has not been established." The Industry is disturbed by the fact that the goals recommended in the report are based on existing technology and not on environmental need, which is inconsistent with the committee's recommendations on other parameters.

Response:

The MISA goal is the virtual elimination of persistent toxic substances. The use of best available technology as a first step towards achieving this goal is a fundamental principle of MISA. Following the installation of best available technology, studies of the receiving waters will be conducted to determine whether further reductions in the levels of organochlorines are necessary. As stated earlier, recent studies in Scandinavia have determined adverse effects of bleached kraft mill effluent on fish that can be directly related to organochlorines. The ministry does not feel that abatement activity to reduce discharges of chlorinated organics should be stalled until the exact details of the relationship are established.

TOX/TOCL

Comment 1: (Industry)

Industry does not accept the constant ratio of 1.3 for TOCL to TOX. The "Pulp and Paper Research Institute of Canada", has found that the multiplier varies with pulp type and bleaching process. Before being committed to any organochlorine levels, Industry believes there should be some agreement on a method for measuring organochlorines and more research to determine the optimum bleaching sequence for minimizing organochlorine levels, before regulations are written.

Response:

As stated earlier, the ministry is adopting the AOX test method for determining organochlorine levels. The ministry believes it is in the Industry's best interests to proceed expeditiously with research into the elimination or reduction

in the formation of organochlorines so that this data will be available for consideration when the limits regulation is developed.

Comment 2: (Industrial Organization)

TOX is a non-specific, generic analytical measurement or calculation that has little correlation to real environmental parameters such as toxicity. There is also little evidence that a reduction in TOX will reduce the levels of persistent toxic chemicals.

Alternatively we would recommend the use of Total Organic Carbon (TOC) as the "catch all" parameter. This would make more sense at this time and probably meet more of the ministry's objectives for reduced environmental impact.

Response:

The ministry understands that TOX (or AOX)is a generic parameter but believes it is the appropriate indicator of toxic chlorinated compounds in mill effluents that can be meaningfully quantified at present. The ministry also believes that reductions in TOX levels will inherently reduce the levels of persistent toxic compounds since most of these have been identified as chlorinated compounds.

TOC is a measure of the total organic carbon and there is little evidence to suggest that reductions in TOC would necessarily lead to reductions in persistent toxics, especially since the latter are normally resistant to treatment methods used to reduce TOC.

Comment 3: (Industrial Organization)

The authors summarize the effects of the main alternative technologies proposed in Table 1.2. The reader cannot fail

to notice that ClO2 substitution is the only technology that does not effect significant improvements in actual environmental parameters. The authors admit that ClO2 has no effect on BOD, variable effects on fish toxicity (the effluent toxicity may increase with ClO2 substitution) and the effect of ClO2 on dioxin formation is unclear.

In general, the effects of ClO2 substitution are much less beneficial than oxygen delignification and a well designed and operated biological treatment plant and in some cases produces a more environmentally deleterious effluent. A serious concern is that mills could adopt this less painful alternative, while not benefiting the environment nor meeting the ministry's expectations of reducing environmental impact.

Response:

The ministry does not agree with this interpretation of Table 1.2, which clearly indicates that ClO2 substitution can yield up to 50% reduction in chlorinated organics. With the emphasis on persistent toxics, the authors have identified a viable means of reduction.

Mills will have to make their own judgement as to the technology they wish to employ in order to comply with ministry limits and ClO2 substitution is viewed as a technology which could contribute to a reduction in environmental impact.

Comment 4: (Industrial Consultant)

The authors have assumed that a reduction in chlorine use in a mill would reduce the production of chlorinated dioxins and furans. They state that some recent studies support that

theory. I would respectfully suggest that the majority of available studies do not support that theory and that factors other than chlorine use are the main culprits in the formation of these substances.

Response:

The ministry recognizes that there are factors other than chlorine use which determine the formation of chlorinated dioxins and furans. However, recent research conducted in Scandinavia and Canada indicates the use of chlorine is directly related to the formation of chlorinated dioxins and furans. The research also indicates that by limiting the use of chlorine the formation of these compounds can be reduced or even eliminated.

DIOXINS

Comment 1: (Industry)

The chapter on dioxins states that TCDD and TCDF output from bleach kraft mills are of concern, but the risk element must be kept in perspective. It is important that Ontario regulators maintain this perspective and it is particularly important for the ministry to recognize that much research needs to be done in terms of both the significance of the presence of these organochlorines and the best process approach to reducing or eliminating their presence.

Response:

The public is concerned about TCDD and TCDF because of their proven health effects. Until further evidence becomes available to reduce this concern, the ministry must address the risk aspect of these compounds from a "protection of the public" viewpoint.

OXYGEN DELIGNIFICATION

Comment 1: (Industrial Consultant)

The environmental benefits of oxygen delignification are questionable from a cost benefit standpoint. The capital costs are understated in the report and the projected operating costs are optimistic.

Response:

The Expert Committee conducted a very thorough analysis of the costs associated with oxygen delignification and would not agree that the figures are optimistic. The perceived benefits of oxygen delignification include a reduction in the formation of organochlorines, which is one of the objectives of the ministry.

Comment 2: (Industry)

The internal rate of return at 11% is insufficient to justify capital investment in the prevailing economic climate. There is no argument with many of the techniques discussed for decreasing recovery boiler load and many mills in Ontario are practising one or more of the techniques mentioned. If boiler load is decreased, either more pulp can be produced or a mill can utilize the capacity to burn the increased black liquor solids generated by oxygen delignification. If oxygen delignification is chosen, then the "lost opportunity" (incremental production limited by recovery boiler capacity) cost must be taken into account in the variable cost analysis.

Response:

It is not clear from the report whether this factor has been taken into account. However, mills will decide to install

oxygen delignification on the basis of several factors. Compliance with Ministry limits and the value of increasing capacity are just two factors that need to be considered.

TOXICITY

Comment 1: (Industry)

Industry is concerned with the contradictory position taken by the committee, namely; no "overt" sub-lethal effects beyond the edge of a mixing zone and the requirement for a non-lethal effluent at the end of the pipe. Industry supports the former but can see no justification for the latter.

Response:

The ministry supports the position taken by the committee. The first step in ensuring a reduction in sub-lethal effects is to have a non-lethal effluent at the end of the pipe.

Comment 2: (Industry)

Toxicity controls should be based on an evaluation of the receiving water as well as the effluent conditions. The Industry is not opposed to biomonitoring or to regulations based on such monitoring, however, the tests employed and the interpretation of the results must be consistent with measured environmental impact.

Response:

The ministry agrees that toxicity controls should be concerned with the receiving waters as well as the effluent but only after baseline controls are in place, consistent

with the MISA objective of a non-toxic effluent. Receiving water considerations will address chronic toxic effects related to persistent toxics.

Comment 3: (Industrial Consultant)

The effluent of any given kraft mill is highly variable. Regulators and mills will have to come to grips with the prospect of periodically failing bioassay tests and how the failures relate to meeting (the intent of) the requirements, or more specifically, control orders.

Response:

The Ministry recognizes that kraft mill effluents are highly variable and may result in failures of bioassays tests. Compliance requirements will be developed on a sound statistical basis which will take into account effluent variability among other items.

Comment 4: (Industrial Consultant)

I applaud the recommendation that bioassays be done on neutralized samples. The toxicity data base in a number of projects on which I have been involved has been effectively ruined because of pH effects in the test protocol. Similarly I would urge that consideration be given to increased air flow rates during the bioassays for two reasons:

a) to strip off volatile toxicants, since environmentally they are of secondary importance relative to persistent toxicants, and

b) this might preclude low oxygen levels killing the fish.

Response:

The ministry will not allow adjustment of effluent pH prior to toxicity testing. The rationale is stated in Appendix A, issue A.13.

The ministry will consider taking increased air flow rates during bioassays.

Comment 5: (Industrial Consultant)

With respect to recommendations for site-specific dissolved oxygen levels and sub-lethal effects, this may be more difficult to regulate and enforce than would first appear -- short-term variations in effluent loadings can be several times (or many more) the average regardless of control facilities within the plant.

Response:

The Ministry recognizes the difficulties in trying to regulate and enforce site-specific DO and sub-lethal effects. However, the Ministry has had success utilizing this approach at sites in the past and intends to continue with this approach.

ECONOMICS

Comment 1: (Industry)

Industry is concerned over the potential total environmental costs for water, air and hazardous wastes. The notion of little real cost to achieve Level III is not consistent with analyses by some of the mills. Capital cost estimates to achieve the proposed level III TOX standards are substantial.

Response:

While the capital costs may be substantial the expert committee has indicated that in most cases, the costs are recoverable in a reasonable time frame.

Comment 2: (Industry)

The economic analysis refers to a model, 750 ton mill. Such a "model" mill does not exist. A number of the mills in Ontario are of lesser scale and therefore, would have a less optimistic investment/savings scenario. A number of mills would require, because of certain site specific needs, further capital investment beyond that forecast in the analysis.

Response:

The ministry acknowledges that such a "model" does not accurately represent kraft mills in Ontario but the committee used the "model" approach to generate data for comparative purposes. The committee acknowledges there is a large variance across the mills in Ontario.

Comment 3: (Industry)

The authors presume that an internal rate of return of 11.4% is acceptable in today's business climate -- let me assure you that it is not.

Response

This rate of return must be viewed in the light of accomplishing environmental requirements at the same time.

The alternative is to expend dollars on environmental technology which has zero rate of return on investment.

Comment 4: (Industry)

The economic impact analysis completely ignores that stringent TOX regulations and dramatically lower chlorine use would cause significant damage to the domestic chloro-alkali industry, with the clear possibility of plant shutdowns and attendant loss of employment. Furthermore, the resultant reduced availability of co-produced caustic soda (i.e., off-balance chlorine/caustic ratio) would cause a dramatic increase in the latter's price.

Response:

There is ample evidence to indicate that the use of chlorine in pulp bleaching results in the formation of organochlorines which are known to include many persistent toxic compounds. The ministry has a responsibility to the citizens of Ontario to reduce the levels of these compounds being discharged into Ontario waters. A reduction in chlorine usage is one of the ways to reduce organochlorine compounds.

The Industry is being put on notice that the use of chlorine for pulp bleaching is likely to decrease with time. This data should be factored into any strategic planning.

APPENDIX C

ONTARIO KRAFT MILL AOX SURVEY

ONTARIO KRAFT MILL AOX SURVEY

A joint MOE-Environment Canada study was initiated in July, 1988 to obtain data on the current levels of AOX (chlorinated organic compounds) in Ontario's kraft mill effluents. The study will also provide information which will be used by the Ministry to develop AOX testing methods, i.e., sampling procedures, analytical protocols, and quality control/quality assurance measures.

Initial data on the current levels of AOX in mill discharges are presented in Table C-1. The data in Table C-1 include the results from samples taken at each mill during summer and winter operating conditions. A third round of sampling is planned for April/May of 1989.

Additional data on AOX levels at some mills were received from industry and are presented in Table C-2.

These initial results cannot be considered conclusive but do provide an indication that levels are likely to be substantially lower than those predicted by the Expert Committee. Further monitoring, which will be conducted under the MISA Pulp and Paper Monitoring Regulation beginning in late 1989, will provide more comprehensive data necessary to accurately assess discharge levels.

One reason which partially accounts for the discrepancy between the AOX levels found by this study and those reported by the Expert Committee is that the discharge levels reported by the Experts were calculated values, based on mill chlorine usage. It is now generally acknowledged that the calculation method used by the Experts yields values that are higher than actual.

Another reason is that since the Expert Committee report was released, some kraft mills have made changes to their operations which have resulted in lower AOX levels. For example, some mills have changed their bleaching operations in an effort to reduce the levels of chlorinated dioxins and furans formed in the bleaching process. These changes have also resulted in a reduction in AOX levels.

TABLE C-1

ONTARIO KRAFT MILL AOX SURVEY

MILL	SAMPLE DATES 1988	AOX LEVEL (kg/ADT)
Mill A	Aug. 8	2.3
	Dec. 5-6	3.3
Mill B	Jul. 19	1.0
	Dec. 13-14	0.9
Mill C	Jul. 27	2.3
	Dec. 5-6	1.5
Mill D	Aug. 10	3.7
	Nov. 30-Dec. 1	3.9
Mill E	Aug. 12	2.2
	Nov. 29-30	2.3
Mill F	Jul. 25	3.9
	Dec. 1-2	4.8
Mill G	Aug. 18	1.8
	Dec. 14-15	0.9
Mill H	Jul. 22	3.5
	Nov. 29-30	3.5
Mill I	Jul. 29	*7.1
	Dec. 8-9	*4.9

* Based on nominal semi-bleached kraft pulp production because actual production figure is not available for that particular mill.

NOTE: Sampling was carried out by Environment Canada under the joint MOE-Environment Canada Study.

TABLE C-2

AOX Data Reported by Industry

MILL	SAMPLE DATES	# OF SAMPLES	AOX LEVEL (kg/ADT)
Mill A	*Jul./88	2	2.6
	Aug./88	1	2.1
	*Aug./88	3	3.6
Mill B	*Jan./88	3	1.3
	*Feb./88	4	1.3
	*Mar./88	4	1.3
	*Apr./88	3	1.3
	*May./88	4	1.3
	*Jun./88	4	1.3
	*Jul./88	2	1.1
	*Aug./88	5	1.2
	Nov./88	1	1.5
	Dec./88	1	1.3
Mill D	*Aug./88	3	3.6
	*Sep./88	3	2.9
	*Oct./88	4	3.7
	*Nov./88	4	5.2
	Dec./88	1	5.0
Mill E	Nov./88	1	2.8
	*Dec/88	2	2.7
	*Jan./89	2	2.9
	*Feb./89	2	3.3

* Monthly average of data submitted

APPENDIX D

GENERIC CONTROL ORDER

GENERIC CONTROL ORDER

TO:

Section 1 WHEREAS, section 6 of the Environmental Protection Act, R.S.O. 1980, c. 141 as amended, (the "EPA") provides that when a report of a provincial officer contains a finding that a contaminant discharged into any part of the natural environment by any person or from any source of contaminant contravenes Section 13 of the Act, the Director may issue a control order directed to the person responsible therefor.

Section 2 AND WHEREAS, section 17 of the EPA provides that the Director may require a person who owns or who has management or control of an undertaking or property to have available at all times the equipment, material and personnel specified, to install or modify the devices, equipment and facilities specified, to implement the procedures specified and to monitor and record the discharge into the natural environment of a contaminant and to report thereon to prevent the discharge of a contaminant or to prevent, decrease or eliminate an adverse effect.

Section 3 AND WHEREAS, section 17 of the Ontario Water Resources Act, R.S.O. 1980, c. 361 as amended, (the "OWRA") provides that the Director may by order prohibit or regulate the discharge by any person of sewage into or in any waters.

Section 4 AND WHEREAS, section 18 of the OWRA provides that the Director may require a person who owns or who has management or control of a sewage works or other facility which may discharge material into a water or watercourse that may impair the quality of the water to have available at all times the equipment, material and personnel specified, to install or modify the devices, equipment and facilities specified, to implement the procedures specified and to monitor and record the quality of any water and to report thereon.

Section 5 AND WHEREAS, section 51 of the OWRA provides that where an industrial or commercial enterprise makes arrangements for the collection, transmission, treatment or disposal of sewage that are considered unsatisfactory by the Director, the Director may require investigations to be made, reports to be submitted and facilities to be put in place and operated.

Section 6 AND WHEREAS, the report prepared by _____, a Provincial Officer, contains a finding with regard to operations at the _____ mill (the "mill") located at _____ (the "Property") that the suspended solids, five day biochemical oxygen demanding substances (BOD_5), toxic substances and adsorbable organic halides discharged by _____ (the "Company") in its mill effluent cause or are likely to cause an adverse effect, contrary to Section 13 of the EPA.

Section 7 AND WHEREAS, the Company is the owner, or is in occupation of, or has charge, management or control of the mill or the Property. As such, the Company is the person responsible for any source of contaminants from the mill or the discharge of sewage as those terms are defined in the EPA and the OWRA.

Section 8 AND WHEREAS, the Minister of the Environment has accepted, with modifications, the recommendations of the Expert Committee on Kraft Mill Toxicity as outlined in the report "Kraft Mill Effluents in Ontario" dated April, 1988.

Section 9 AND WHEREAS, the Minister of the Environment has given notice of his intention to put in place effective controls to safeguard the environment until more comprehensive and stringent regulatory measures are imposed.

Section 10 AND WHEREAS, the Company has responded to the notice referred to in section 9 of this order by requesting that this order be issued in the form indicated herein which reflects the result of negotiations with the Company.

Section 11 AND WHEREAS, notice of my intention to issue this order, written reasons therefor, and a copy of the Provincial Officer's report were served upon the Company on the ____ day of _____ 19 . In that notice submissions were invited on or before the ____ day of _____ 19 .

Section 12 AND WHEREAS, I am of the opinion, based on the report, that the operations on the Property are such that if a contaminant is discharged into the natural environment and no action is taken to prevent it, the contaminant will result or is likely to result in an adverse effect and that the requirements specified in this order are necessary to prevent the discharge of a contaminant and the adverse effects that will result or are likely to result from the discharge of a contaminant.

Section 13 AND WHEREAS, I am of the opinion, based on the report, that the operations on the Property are such that if material is discharged into a water or watercourse and no action is taken to prevent it, the discharge may impair the quality of the water and that the requirements specified in this order are in the public interest.

Section 14 AND WHEREAS, I consider unsatisfactory the arrangements made by the Company for the collection, transmission, treatment and disposal of sewage.

Section 15 THEREFORE, pursuant to the authority vested in me by sections 6 and 17 of the EPA and sections 17, 18 and 51 of the OWRA, I hereby order the Company to do the following:

Action Plan and Contingency Plan

Section 16 By December 1, 1989, submit, for approval of the Director, a written action plan for compliance with the other provisions of this order including dates for the submission of all necessary applications for a Certificate of Approval as well as construction and completion dates for any measures to be taken.

Section 17 Forthwith, upon written notification of approval of the Director, put in place the action plan referred to in section 16, as amended from time to time with the written approval of the Director.

Section 18 By December 1, 1989, submit a written contingency plan detailing the existing and proposed plans, equipment, facilities, materials and personnel available, as well as the procedures to be implemented, to alleviate any adverse effects that may be caused by a spill of a pollutant from the operations on the Property.

Section 19 Forthwith, upon written notification of approval of the Director, put in place the contingency plan referred to in Section 18, as amended from time to time with the written approval of the Director and carry it out as required by the contingency plan.

Monitoring and Reporting

Section 20 Commencing on the date this order becomes enforceable and daily thereafter, monitor the following parameters:

(a) daily concentrations in mg/l and daily loadings in tonnes/day for both BOD_5 and suspended solids (including a calculation of BOD_5 and suspended solids in kilograms/tonne of product) based on a 24 hour composite sample representative of the effluent and using standard methods;

(b) daily production of pulp (total ADt bleached kraft pulp in tonnes and total ADt of product);

(c) daily effluent flow rate (in 10^3 x m^3/day);

(d) daily maximum pH and daily minimum pH including the length of time pH was less than 5.5 or greater than 8.5 for more than 30 minutes, as recorded by a continuous pH recorder on the effluent outfall; and

(e) daily maximum and daily minimum conductivity as recorded by a continuous conductivity recorder on the effluent outfall.

Section 21 Commencing on the date this order becomes enforceable and thrice weekly thereafter on separate working days, monitor adsorbable organic halides (AOX) based on a 24 hour composite sample representative of the effluent and using standard methods.

Section 22 Commencing on the date this order becomes enforceable and weekly thereafter, monitor total phosphorus, ammonia, Kjeldahl nitrogen, nitrate nitrogen and nitrite nitrogen based on a 24 hour composite sample representative of the effluent and using standard methods.

Section 23 Commencing on the date this order becomes enforceable and monthly thereafter, in accordance with a schedule filed with the Director which shall provide for sampling at approximately thirty day intervals, monitor resin and fatty acids based on a 24 hour composite sample representative of the effluent and using standard methods.

Section 24 Commencing on the date this order becomes enforceable and monthly thereafter, in accordance with a schedule filed with the Director which shall provide for sampling at approximately thirty day intervals, conduct a static bioassay toxicity test based on a 24 hour composite sample representative of the effluent and using standard methods. The samples shall be taken during days when the mill is in production and if the mill is not in production on a scheduled sampling day, the samples may be taken during the preceding week or on the next succeeding day that the mill is in production.

Section 25 The monthly sampling referred to in Section 24 may be reduced to quarterly sampling, in particular, during the _____ week of _____, the _____ week of _____, the _____ week of _____, and the _____ week of _____, if the monthly effluent samples prove non-lethal (i.e. LC_{50} greater than or equal to 100%) over three consecutive months when tested using standard methods. This reduction in sampling frequency applies for so long as the samples prove non-lethal (i.e. LC_{50} greater than or equal to 100%), otherwise, the monthly sampling prescribed by Section 24 applies unless and until the samples prove non-lethal (i.e. LC_{50} greater than or equal to 100%) over three consecutive months when tested using standard methods.

Section 26 Within 30 days after the end of the month in which the first samples are collected and monthly thereafter, submit to the Director a written report summarizing the loadings described in Sections 20, 21, 22 and 23 of this order and the results of the toxicity tests required under Section 24 of this order.

Section 27 By December 1, 1989 and daily thereafter, ensure that all flow monitoring and recording equipment is operating to within $\pm$ 15% precision.

Section 28 Commencing on the date this order becomes enforceable and at least monthly thereafter:

(a) perform inspections and any necessary maintenance on all flow monitoring and recording equipment to ensure continuous and accurate operation; and

(b) maintain an inspection and maintenance record of the precision of all flow monitoring and recording equipment for verification by Ministry staff.

Section 29 By December 1, 1989 and at least annually thereafter, calibrate the flow monitoring and recording equipment to within $\pm$ 15% precision and submit a calibration report to the Director with details of:

(a) the calibration method used;

(b) the error in flow measurement prior to calibration;

(c) the cause of any flow measurement error;

(d) the precision of the flow measurement equipment after calibration; and

(e) the effect of any error on reports submitted under Sections 26, 38 and 39 of this order.

Section 30 In the event of a change or modification that may affect the calibration of the flow monitoring and recording equipment, forthwith calibrate the flow monitoring and recording equipment to within $\pm$15% precision and forthwith submit the report referred to in Section 29.

Section 31 By December 1, 1989 and daily thereafter, ensure that all samples are collected by,

(a) using an automatic flow proportional composite sampling device;

(b) manually collecting a minimum of eight grab samples at equal time intervals and combining them in proportion to flow;

(c) using an automatic sampling device that collects and combines equal volume sub-samples at equal time intervals not exceeding fifteen minutes;

(d) manually collecting a minimum of eight grab samples at equal time intervals and combining them in equal volumes; or

(e) using an on-line analyzer that collects and analyzes samples continuously or at equal time intervals not exceeding thirty minutes.

Biochemical Oxygen Demand & Suspended Solids

Section 32 (a) Commencing on the date this order becomes enforceable and daily thereafter, control the effluent to ensure that BOD_5 does not exceed _____, when tested using standard methods;

(b) By December 31, 1991 and daily thereafter, control the effluent to ensure that BOD_5 does not exceed _____ tonnes on any one day, inclusive of allowable error, when tested using standard methods; and

(c) By December 31, 1991 and daily thereafter, control the effluent to ensure that BOD_5 does not exceed _____ kilograms/ADt of product averaged over any 30 consecutive working days, when tested using standard methods.

(d) For purposes of this section:

i) "allowable error" means an error in flow measurement not exceeding $\pm$15% and an error in analysis not exceeding $\pm$25%; and

ii) the error in calculating the average over any 30 consecutive working days due to error in flow measurement and daily analysis is deemed to be equal to zero.

Section 33 (a) Commencing on the date this order becomes enforceable and daily thereafter, control the effluent to ensure that suspended solids do not exceed _____, when tested using standard methods;

(b) By December 31, 1991 and daily thereafter, control the effluent to ensure that suspended solids do not exceed _____ tonnes on any one day, inclusive of allowable error, when tested using standard methods; and

(c) By December 31, 1991 and daily thereafter, control the effluent to ensure that suspended solids do not exceed _____ kilograms/ADt of product averaged over any 30 consecutive working days, when tested using standard methods.

(d) For purposes of this section:

i) "allowable error" means an error in flow measurement not exceeding ±15% and an error in analysis not exceeding ±10%; and

ii) the error in calculating the average over any 30 consecutive working days due to error in flow measurement and daily analysis is deemed to be equal to zero.

Section 34 For purposes of determining whether or not the limit in Section 32(c) or Section 33(c) is exceeded, each day that the limit specified in Section 32(b) or Section 33(b) is exceeded, shall be deemed to be equal to the limit specified in Section 32(c) or Section 33(c) as the case may be.

Toxicity

Section 35 By December 1, 1989, conduct a study to determine the effect on the toxicity of the effluent of measures taken to achieve compliance with this order and submit to the Director a written report of:

(a) the findings of the study; and

(b) the anticipated 96-hour LC_{50} toxicity of the effluent as of December 31, 1991, when tested using standard methods.

Section 36 By December 31, 1991 and daily thereafter, control the effluent to ensure that the toxicity of the effluent does not exceed the toxicity referred to in Section 35(b) of this order, as amended from time to time with the written approval of the Director, when tested using standard methods.

Adsorbable Organic Halides

Section 37 By December 31, 1991 and daily thereafter, control the effluent to ensure that adsorbable organic halides (AOX) in the effluent do not exceed 2.5 kilograms/ADt of bleached kraft pulp when calculated by averaging the loadings measured pursuant to Section 21 of this order over any four consecutive weeks divided by the bleached kraft pulp produced in that period as estimated by a method approved in writing by the Director.

Progress Reports

Section 38 By January 1, 1990 and for every six month period thereafter to December 31, 1991, submit a written report to the Director detailing the measures taken to comply with this order.

Section 39 By January 1, 1990, submit a written report to the Director specifying the extent to which adsorbable organic halides have been reduced as a result of measures taken to comply with this order to January 1, 1990 which have the effect of reducing adsorbable organic halides and specifying the extent to which adsorbable organic halides will be reduced by measures to be taken to comply with this order that have the effect of reducing adsorbable organic halides.

Section 40 By June 30, 1991, submit a written report to the Director specifying the extent to which BOD_5, suspended solids, toxicity and adsorbable organic halides have been reduced by measures taken to comply with this order to June 30, 1991 and the extent to which BOD_5, suspended solids, toxicity and adsorbable organic halides will be reduced by measures to be taken to comply with this order.

Section 41 All composite samples are deemed to be representative of the effluent for purposes of determining compliance with limits in this order.

Section 42 Requirements specified in this order are minimum requirements and do not abrogate the need to comply with all provisions of applicable legislation.

Section 43 In the event of a conflict between this order and an existing order, this order prevails.

Section 44 In the event that a regulation is promulgated which prescribes requirements for sampling, monitoring, testing, reporting or the control of effluent parameters dealt with in this order, the requirements specified in the regulation prevail.

Section 45 The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstance is held invalid, the application of such requirement to other circumstances and the remainder of this order shall not be affected thereby.

Section 46 The Company shall ensure that at all times, the mill and related equipment and appurtenances which are installed or used to achieve compliance with this order are properly operated and maintained.

Section 47 The Company shall ensure that adequate equipment and materials are kept on hand, maintained and kept in good repair for immediate use in the event of upset conditions, equipment breakdowns and spills of raw or processed materials, and that appropriate personnel are trained in its use and the methods and procedures to be employed.

Section 48 In the event of the Company being rendered unable to perform or to comply with any obligations herein because of:

(a) natural phenomena or accident of an exceptional, inevitable or irresistible character;

(b) insurrection or act of public enemy;

(c) strikes, lock outs or other industrial disturbances;

(d) exercise of statutory authority or order of authority of competent jurisdiction;

(e) reasonably apprehended imminent harm to human health or safety;

(f) fire or explosion without negligence and beyond the reasonable power of the company to prevent or control;

(g) inability to obtain materials or equipment for reasons beyond the reasonable control of the Company;

(h) latent defect in materials, equipment or processes for reasons beyond the reasonable control of the Company; or

(i) any other cause whether similar to or different from the foregoing beyond the reasonable control of the Company;

the obligations hereof, may be adjusted in a reasonable manner to be defined by the Director. To obtain such an adjustment, the Company must notify the Director without undue delay of any of the above occurrences, providing details that establish no reasonable alternatives are feasible to meet the obligations in question.

Section 49 During the course of this order, the Company and its employees shall at all times exercise reasonable care in all matters relating to Company operations, to minimize the discharge of contaminants and to minimize any adverse impact on the environment that may be caused by the discharge of contaminants.

Section 50 Further requirements whether in respect to contaminants dealt with in this order or not so dealt with may be imposed by the Director according to law.

Section 51 Any request to change a requirement in this order should be made, in writing, to the Director, with reasons for the request, at least 14 days prior to any compliance date for that requirement.

Section 52 This order applies, except when stayed by appeal, from the date of issuance and expires when revoked. The commencement of an appeal does not operate as a stay of an order to monitor, record and report that is part of a control order.

Section 53 Pursuant to the authority vested in me by Section 115 of the EPA, I hereby revoke sections __, __, __, and __ of the control order issued to _____, dated _____.

Section 54 Pursuant to section 122 of the EPA and section 61 of the OWRA, the Company may require a hearing before the Environmental Appeal Board if, within 15 days after service upon the Company of a copy of this order, the Company serves written notice upon the Director and the Environmental Appeal Board.

Section 122a of the EPA and section 63 of the OWRA require that the notice requiring the hearing include a statement of the portions of the order in respect of which the hearing is required and the grounds on which the Company intends to rely at the hearing.

Notice requiring a hearing should be served personally or by registered mail upon:

The Secretary
Environmental Appeal Board
112 St. Clair Avenue West, Suite 502
Toronto, Ontario
M4V 1N3

and

_____
Regional Director
_____ Region
Ministry of the Environment

_____
_____

Issued at _____ this _____ day
of _____ 1989.

_____
XXXXXXXXXXX
Director
Sections 6 and 17
Environmental Protection Act
Sections 17, 18 and 51
Ontario Water Resources Act

GLOSSARY

1. "Air Dried Metric Tonne (ADt)" means product as weighed in accordance with standard industry practice, for purposes of inventory control and billing, normally containing no more than 10% moisture.

2. "averaged over any 30 consecutive working days" means the average calculated from the loadings data for 30 working days following one day after the other, but which may be interrupted by non-working days which shall not be included in calculating the average.

3. "BOD_5" (biochemical oxygen demand) means a property of effluent determined by measuring the amount of oxygen consumed by a sample under controlled conditions (20° C, neutral pH) using a five day test.

4. "composite sample" means a volume of effluent made up of three or more samples that have been combined automatically or manually or a sample obtained from a slip stream to an on-line analyzer.

5. "Director" means the Director, _____ Region, _____ Street, _____, Ontario, _____.

6. "effluent" means any liquid and associated material discharged directly or indirectly to any waters.

7. "LC_{50}" means the concentration of a test material that causes death of 50 percent of a population in a 96 hour period of time.

8. "Ministry" means the Ministry of the Environment for the Province of Ontario.

9. "product" means all manufactured cellulose fibre material.

10. "standard methods" means:

    (a) a procedure published by the Ontario Ministry of the Environment as either a standard method or the equivalent of a standard method, current at the date of testing;

(b) a procedure set out in Standard Methods for the Examination of Water and Wastewater published jointly by the American Public Health Association, American Water Works Association and the Water Pollution Control Federation, 16th Edition (1985), current at the date of testing, if no procedure has been published by the Ontario Ministry of the Environment; or

(c) a procedure approved by the Director, as amended at the date of testing.

11. "working day" means any day during which the digester, brown stock washers, bleachery or other machines for the manufacturing of cellulose fibre material operate for all or any part of that day, from 7 a.m. to 7 a.m of the following day.